

What is claimed is:

1. Apparatus for supplying liquid color to a plastic material processing machine, comprising:
 - a. a sealable container for storing liquid color therewithin;
 - b. a pump within said container, having an inlet proximate the container bottom; and
 - c. a conduit connected to an outlet of said pump and passing through said container to deliver pumped liquid color at the container exterior.
2. Apparatus of claim 1 further comprising self-sealing means connected to said conduit at the exterior of said container for preventing flow of liquid color out of said container via said conduit upon disconnection of said apparatus from a liquid color user.
3. Apparatus of claim 2 wherein said self-sealing means is a spring-loaded manually actuable quick-disconnect.
4. Apparatus of claim 1 further comprising liquid color within said container.
5. Apparatus of claim 1 wherein said pump is a diaphragm pump.
6. Apparatus of claim 1 wherein said pump is pneumatically actuated.
7. Apparatus of claim 1 wherein said pump is mechanically actuated.
8. Apparatus of claim 1 wherein said pump is electrically powered.

9. Apparatus of claim 2 further comprising liquid color within said container.
10. Apparatus of claim 2 wherein said pump is a diaphragm pump.
11. Apparatus of claim 2 wherein said pump is pneumatically actuated
12. Apparatus of claim 2 wherein said pump is mechanically actuated.
- 5 13. Apparatus of claim 2 wherein said pump is electrically powered.
14. Apparatus of claim 1 wherein said pump further comprises:
- a. a body having a cavity formed therein;
 - b. a cover connected to said body;
 - c. a flexible diaphragm separating said cover from said cavity;
 - 10 d. said cover having a relief proximate the portion of said diaphragm separating said cover from said cavity, providing space between said cover and said diaphragm;
 - e. means for cyclically displacing said diaphragm away from said relief area of said cover and into said cavity;
 - 15 f. means for biasing said diaphragm away from said cavity, towards said relief area of said cover and into said space during a portion of each cycle of diaphragm displacement.
15. Apparatus of claim 14 wherein said means for cyclically displacing said diaphragm is pneumatically driven.
- 20 16. Apparatus of claim 14 wherein said means for cyclically displacing said diaphragm moves about an axis.

17. Apparatus of claim 14 wherein said means for cyclically displacing said diaphragm moves rotatably.
18. Apparatus of claim 14 wherein said means for cyclically displacing said diaphragm is a reciprocating means.
- 5 19. Apparatus of claim 18 wherein said means for cyclically displacing said diaphragm is electrically driven.
20. Apparatus of claim 18 wherein said mind for cyclically displacing said diaphragm is mechanically driven.
21. Apparatus of claim 18 wherein said reciprocating means contacts said diaphragm.
- 10 22. Apparatus of claim 14 wherein said means for biasing said diaphragm away from said cavity is a spring.
23. Apparatus of claim 2 wherein said spring is a coil spring.
24. Apparatus of claim 23 wherein said body has an inlet passageway connecting a pump exterior surface to said cavity, at least a portion of said passageway being substantially vertical, and said pump further comprises a first freely vertically movable ball residing in said passageway vertical portion, for blocking downward liquid flow within said passageway and out of said pump.
- 15 25. Apparatus of claim 24 wherein said ball is within said spring.
- 20 26. Apparatus of claim 25 wherein said spring constrains said ball against

lateral movement.

27. Apparatus of claim 24 wherein said pump external surface is a bottom surface of said pump body.

28. Apparatus of claim 24 further comprising an outlet passageway leading from a vertical extremity of said cavity to the exterior of said pump for conveyance of liquid color displaced from said cavity by said diaphragm out of said pump.

29. Apparatus of claim 24 further comprising an outlet passageway communicating with said cavity adjacent to said diaphragm and leading to the exterior of said pump for conveyance of liquid color displaced from said cavity by said diaphragm out of said pump.

30. Apparatus of claim 28 wherein said outlet passageway has a vertical portion and said pump further comprises a first freely vertically movable ball residing in said outlet passageway vertical portion, for blocking downward liquid flow within said outlet passageway and into said pump.

31. A method for furnishing liquid color to a plastics resin processing machine, comprising:

a. providing a closed container, having an outlet, with liquid color material therewithin;

b. pumping said liquid color material out of said container via said outlet by displacing a diaphragm into an open cavity portion of a

solid body within said container thereby forcing liquid color material residing in said open cavity portion of said solid body through an aperture in said solid body and out of said container via said outlet.

5 32. The method of claim 31 wherein said liquid color material resides in said open portion as a result of fluid communication between said open cavity portion and said container interior.

33. The method of claim 31 wherein said displacing is performed cyclically.

10 34. The method of claim 31 wherein said displacing is performed reciprocally.

35. The method of claim 31 wherein said pumping further comprises:

15 a. cyclically displacing the diaphragm in a first direction against liquid color material in a displacement zone thereby to pressurize and displace said liquid color material through a liquid color outlet; and

 b. displacing the diaphragm in an opposite direction away from said displacement zone thereby drawing additional liquid color material into said displacement zone for subsequent displacement thereby as step "a" above is repeated.

20 36. The method of claim 31 wherein said pumping further comprises:

 a. cyclically displacing the diaphragm against liquid color material in

a displacement zone thereby to displace said liquid color material out of said zone through a liquid color outlet; and

- b. displacing the diaphragm away from said displacement zone thereby drawing new liquid color material into said zone for subsequent displacement therefrom as said diaphragm reciprocating flexes away from said zone.

37. A method for supplying liquid color material as a portion of plastic resin material to be further fabricated by molding or extrusion, comprising the steps of:

- a. serially dispensing liquid color material and resin material into the weigh bin of a gravimetric blender by pumping said liquid color material from a container of the same using a diaphragm pump located in said container;
- b. weighing contents of said weigh bin to determine whether there has been a dispense of liquid color thereinto;
- c. continuing to pump from said container as needed for so long as weighing the contents of said weigh bin indicates there has been a dispense of liquid color material thereinto but stopping said pumping from said container and commencing pumping liquid color material from a second container by using a diaphragm pump located thereon when weighing the contents of said weigh bin

indicates lack of dispense of liquid color material thereinto.

38. A liquid color diaphragm pump, comprising:
- a. a body having a cavity formed therein;
 - b. a cover connected to said body;
 - 5 c. a flexible diaphragm separating said cover from said cavity;
 - d. said cover having a relief proximate the portion of said diaphragm separating said cover from said cavity, providing space between said cover and said diaphragm;
 - 10 e. means for cyclically displacing said diaphragm away from said relief area of said cover and into said cavity;
 - f. means for biasing said diaphragm away from said cavity, towards said relief area of said cover and into said space during a portion of each reciprocating cycle of diaphragm displacement.
39. The pump of claim 38 wherein said means for cyclically displacing said diaphragm is a reciprocating means.
- 15 40. The pump of claim 39 wherein said reciprocating means contacts said diaphragm.
41. The pump of claim 38 wherein said means for biasing said diaphragm away from said cavity is a spring.
- 20 42. The pump of claim 41 wherein said spring is a coil spring.
43. The pump of claim 42 wherein said body has an inlet passageway

connecting a pump exterior surface to said cavity, at least a portion of said passageway being substantially vertical and said pump further comprises a freely vertically floating ball residing in said passageway vertical portion, for blocking downward liquid flow therewithin.

- 5 44. The pump of claim 43 wherein said ball is within said spring.
45. The pump of claim 44 wherein said spring constrains said ball against lateral movement.
46. The pump of claim 45 wherein said pump external surface is a bottom surface of said pump body.
- 10 47. The pump of claim 43 further comprising an outlet passageway leading from a vertical extremity of said cavity to the exterior of said pump for conveyance of liquid color displaced within said cavity by said diaphragm out of said pump.
48. The pump of claim 43 further comprising an outlet passageway leading from said cavity, at a locale adjacent to said diaphragm, to the exterior of said pump for conveyance of liquid color displaced within said cavity by said diaphragm out of said pump.
- 15 49. Apparatus for furnishing liquid color on demand, comprising:
- a. a container having a quick disconnect fitting for output of liquid
- 20 color therefrom;
- b. means, within said container, for pumping liquid color out of said

container responsive to pressurized gas furnished thereto,
comprising:

- i. an upper portion;
- ii. a body connected to said upper portion, having an open
interior cavity facing said upper portion, a liquid color inlet
communicating with said open interior cavity and a liquid
color outlet also communicating with said open interior
cavity remotely from said inlet aperture;
- iii. a check valve within said inlet for permitting inflow of
liquid from within said container into said open interior
cavity but blocking outflow from said open interior cavity
into said container;
- iv. a diaphragm between said upper portion and said open
interior of said body, edges of said diaphragm being
sandwiched between said upper portion and said body,
being distendable towards and into said open interior cavity
of said body responsively to application of force to a
diaphragm side facing oppositely from said open interior
cavity to displace liquid having entered said open interior
of said body through said inlet orifice from said body
through said outlet and out of said container via an outlet

connection by urging a diaphragm surface facing said open interior cavity of said body against liquid color present therein; and

- v. a spring for biasing said diaphragm away from said open interior of said body.

50. Apparatus of claim 49 further comprising liquid color in said container.

51. Apparatus for furnishing liquid color on demand comprising:

- a. a container having a liquid color outlet connection;
- b. a pneumatic piston-cylinder combination removably connected to said container, for providing pneumatically-driven reciprocation of an output shaft portion thereof,
- c. a reciprocable rod within said container and adapted for reciprocating driving thereof by said output shaft of said piston-cylinder combination;
- d. diaphragm pump means, housed at least partially within said container, for pumping liquid color out of said container via said outlet connection, comprising:
 - i. an upper housing part having a relief with an aperture therein;
 - ii. a body connected to said upper housing part and having an open interior cavity facing said relief of said upper housing

part, said body having a liquid color inlet aperture communicating with said open interior cavity and an outlet aperture communicating with said open interior remotely from said inlet aperture;

5 iii. a check valve at said inlet aperture for permitting inflow of liquid color from within said container into said open interior cavity but blocking efflux of said liquid color outwardly from said open interior cavity through said inlet aperture;

10 iv. a diaphragm between said upper housing part and said open interior cavity of said body, being distendable towards and into said open interior cavity of said body responsively to axial reciprocating movement of said rod through said aperture in said relief of said upper housing part to serially
15 displace liquid in said open interior cavity from said body through said outlet orifice and out of said container via said outlet connection; and

 v. a spring for biasing said diaphragm away from said open interior portion of said body and into space proximate said
20 relief.

52. Apparatus of claim 51 further comprising liquid color in said container.

53. A method for supplying liquid color material as a portion of plastic resin material to be further fabricated by molding or extrusion comprising the steps of:

- a. respectively serially dispensing constant volume portions of liquid color material a constant distance during each cycle out of a container and into a weigh bin by cyclically moving a diaphragm a constant distance within said container of liquid color material;
- b. monitoring the amount of liquid color material in said container while continuing said serial dispenses;
- c. when the amount of liquid color material in said container becomes so small that successful pumping of the same is problematical for uninterrupted continuation of said serial dispenses, deactuating said diaphragm within said container and actuating a second diaphragm in a second container of liquid color material thereby continuing said respective serial dispenses.

54. The method of claim 37 wherein said pumping of liquid color for a preselected time further comprises:

- a. generating pulse signals;
- b. applying said pulse signals to said diaphragm pump thereby to pulse said pump;
- c. measuring the time duration of said pulses;

- d. accumulating said measured time duration of said pulses;
- e. comparing the accumulated time duration of said pulses to said preselected time and stopping generating a pulse signal and thereby stopping the pump when said accumulated pulse time duration equals said preselected time.

55. Apparatus for driplessly furnishing liquid color for subsequent processing, comprising:

- a. an outer conduit comprising a stop proximate a first end, a portion of the outer conduit interior proximate said first end being exposed, said remaining end including a female latching member;
- b. an inner conduit connectable at one end to a liquid color supply line, a remaining end being telescopingly insertable into said outer conduit, having a liquid color outlet aperture proximate said remaining end, comprising:
 - i. a sleeve movable along the inner conduit exterior responsively to contact with said stop upon insertion of said inner conduit into said outer conduit from a position covering said outlet aperture to a position at which said outlet aperture is exposed;
 - ii. means for biasing said sleeve towards a position closing said outlet aperture;

iii. a spacer, fixed to said inner conduit remote from said outlet aperture, adapted for sliding insertion into said outer conduit following said slideable sleeve and said spring;

iv. male latching means insertable into and retainable by said female latching member upon inner conduit insertion into said outer conduit, for manually releasably retaining said inner conduit in fixed engagement with said outer conduit for discharge of liquid color from said aperture.

56. Apparatus of claim 55 wherein said male latching means is connected to said spacer.

57. Apparatus of claim 56 wherein said male latching means is a pin extending radially from said spacer.

58. Apparatus of claim 56 wherein said sleeve is axially slideable along said inner conduit.

59. Apparatus of claim 55 further comprising a plurality of said outer conduits and a second plurality of said inner conduits, each one of said inner conduits slideably fitting into at least one of said outer conduits and each one of said outer slideably receiving at least one of said inner conduits.

60. Apparatus of claim 58 wherein said inner conduits are connected to liquid color pumps and said outer conduits are positioned so that liquid color exiting from said outlet apertures when said inner and outer conduits are in

telescoping engagement enters the weigh bin of a gravimetric blender.

61. Apparatus for driplessly furnishing liquid color for subsequent processing, comprising:

a. a tubular member having a first end, a remaining end extending away therefrom and being adapted to receive a tubular liquid color supply conduit therewithin, and comprising a stop proximate said first end, a portion of the tubular wall interior proximate said first end being exposed, said remaining end having a receptacle formed therein;

b. a tubular liquid color supply conduit connectable at one end to a liquid color supply line, a remaining end being insertable into said tubular member, having a liquid color outlet aperture in the tubular wall proximate said remaining end, comprising:

i. a sleeve movable along the conduit exterior responsively to contact with said stop upon insertion of said conduit into said member, from a position covering said outlet aperture to a position at which said outlet aperture is exposed;

ii. means for biasing said sleeve towards said remaining end of said conduit;

iii. a spacer, fixed to said conduit remote from said outlet aperture, adapted for sliding insertion into said remaining

end of said member following said axially slideable sleeve
and said spring;

- iv. means insertable into and retainable by said receptacle
upon conduit insertion into said member, for releasably
retaining said conduit in fixed engagement with member
for discharge of liquid color from said aperture.

62. Apparatus of claim 61 wherein said retaining means is connected to said
spacer.

63. Apparatus of claim 62 wherein said retaining means is a pin extending
radially from said spacer.

64. Apparatus of claim 63 wherein said sleeve is axially slideable along said
conduit.

65. Apparatus of claim 64 further comprising a plurality of said tubular
members and a second plurality of said conduits, at least some of said
inner conduits fitting into at least some of said members.

66. Apparatus of claim 65 wherein said conduits are connected to liquid color
pumps and said members are positioned so that liquid color exiting from
said outlet apertures when said conduits are resident within said members
enters the weigh bin of a gravimetric blender.

67. Apparatus for driplessly connecting and thereafter furnishing liquid color
to a reservoir for subsequent processing, comprising:

- 5 a. at least a pair of tubular members each of which having a first end resident within said reservoir, a remaining end extending outwardly from the reservoir exterior, being adapted to receive a rigid conduit end of a liquid color supply line therewithin, and comprising a stop within said portion of said tubular member within said reservoir, a portion of the tubular walls proximate said first ends exposing the interior of a respective tubular member, said remaining ends each having slots formed therein opening into
10 respective annular axially facing end surfaces of the respective tubular member; said slot extending initially axially and then angularly and including an axial undercut at the slot angular extremity remote from said initial axial portion;
- 15 b. a plurality of a rigid tubular conduit each connectable at one end to said liquid supply line and a remaining end being insertable into one of said tubular members, each having a liquid color outlet aperture in the tubular wall proximate said remaining end and comprising:
- 20 i. an axially slidable sleeve movable along the exterior of said conduit, responsively to contact with said stop upon insertion of said tubular conduit into any one of said tubular members, from a position proximate said remaining end

and covering said outlet aperture to a position at which said outlet aperture is exposed;

ii. spring means connected to the exterior of said conduit and biasing said slidable sleeve towards said remaining end of said tubular conduit;

iii. a spacer, fixedly connected to said conduit remote from said one end and proximate said liquid supply line, adapted for sliding insertion into said remaining end of any one of said tubular members subsequent to said axially slidable sleeve and said spring; and

iv. a pin mounted in and extending radially from said spacer, insertable into and retainable by said receptacle slot in a tubular member upon conduit inserter and subsequent axial and then angular movement of said conduit respecting a respective tubular member, for releasably retaining said rigid tubular conduit in fixed engagement with the respective tubular member for discharge of liquid color.